

U. S. DOE Distributed Energy Resources Program/Peer Review

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Office of Power Technologies
November 28, 2001**



Energy Secretary Spencer Abraham



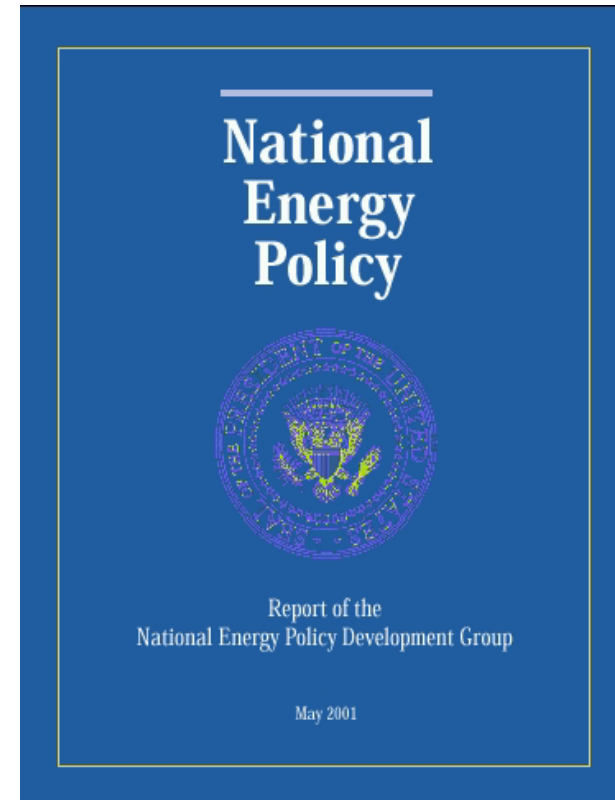
Three major energy challenges for America over the next two decades...

- **Demand for energy rising across the board, especially electricity and gas**
- **Supply limited by a failed regulatory structure and uncertain political environment**
- **Energy infrastructure is woefully antiquated and inadequate**

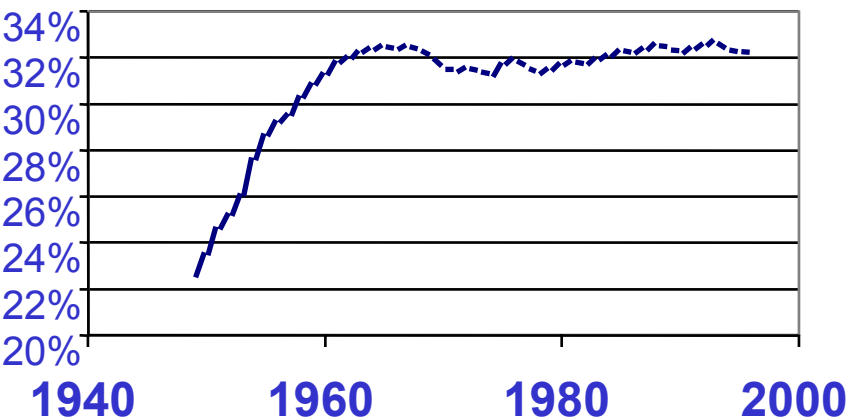
Spencer Abraham, U.S. Chamber of Commerce, March 19, 2001

Of the 105 total recommendations...

- 21 affect distributed energy
- 13 affect T&D
- 8 affect international activities
- 17 affect renewable energy



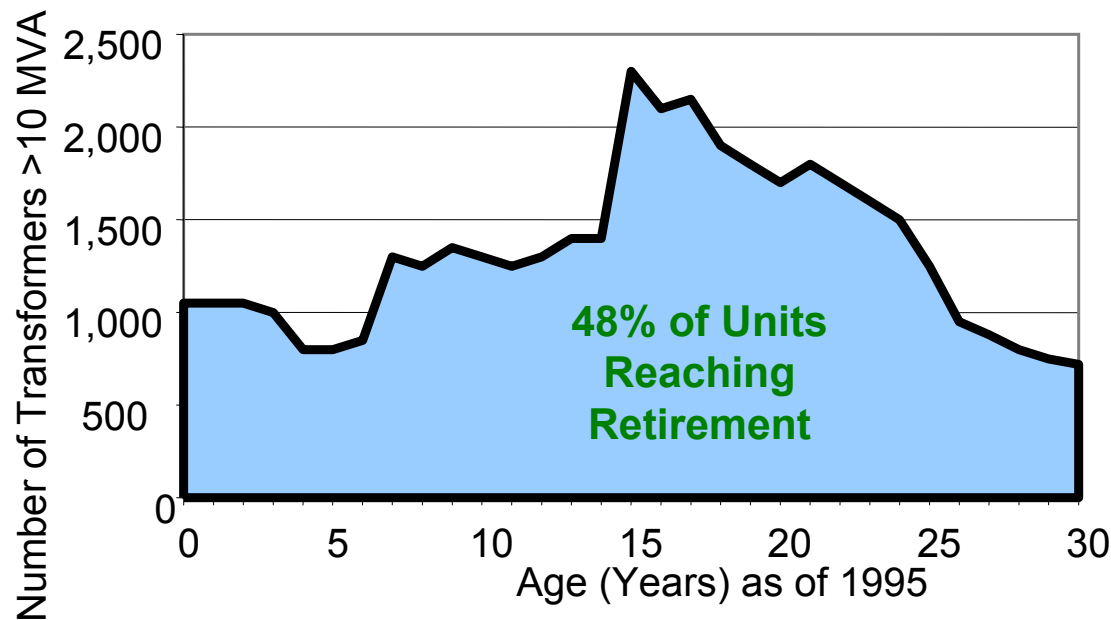
Aging Power Infrastructure



**Fossil Electric Generation
Efficiency (at plant, W/O T&D)**

Source: EIA, Annual Energy Review 1996

Installed Transformer Banks in the U.S.



Source: Waukesha Electric Systems 1997

Electric Power Constraints



“If the energy infrastructure of this country is inadequate or in some way excessively costly, it will undermine economic growth, and is therefore a major issue that must be addressed.”

Alan Greenspan, January 26, 2001



2009 Projections

 **Areas with Capacity Margins < 10 percent**



Power Outages & Reliability

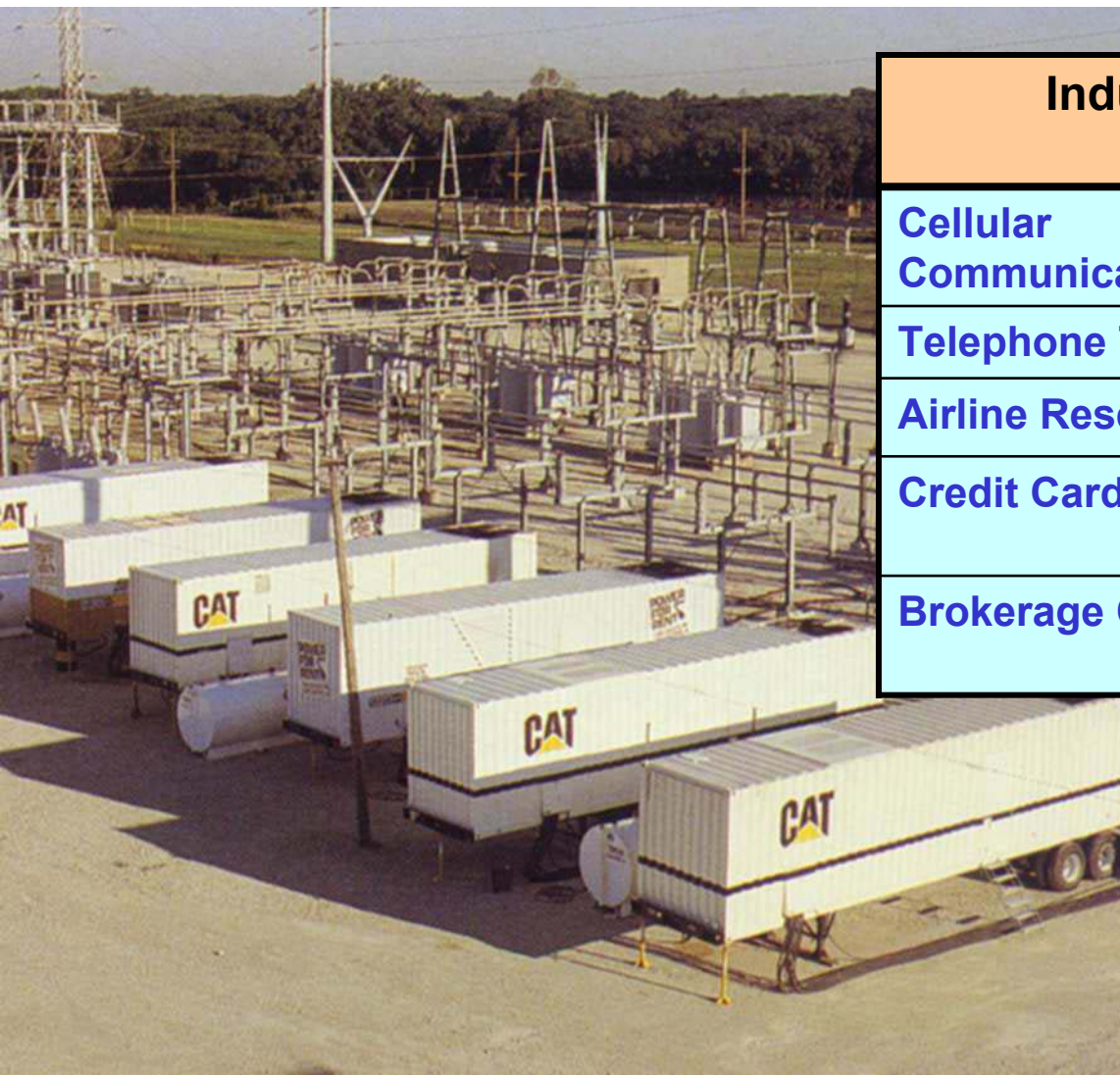


Regions Forecasting Capacity Margins < 10% in 2009

	Affected NERC Regions (WSCC, MAPP, ERCOT, ECAR, NPCC, and MAAC)	U.S. Total	% of U.S. Total
Number of Customers (1999)	~81 million	125.2 million	~65%
Electric Sales (million kWh in 1999)	~1,959,734	3,235,899	~60%
Revenue from Electric Sales (1999)	~\$137 billion	\$215.5 billion	~63%

Source: U.S. DOE, Energy Information Administration, Electric Power Annual 1999, Volume II, October 2000.

Power Reliability Costs



Industry	Average Cost of Downtime
Cellular Communications	\$41,000 per hour*
Telephone Ticket Sales	\$72,000 per hour**
Airline Reservations	\$90,000 per hour**
Credit Card Operations	\$2,580,000 per hour**
Brokerage Operations	\$6,480,000 per hour**

*Teleconnect Magazine

**Contingency Planning Research-1996

- Diversity of energy supplies
- “Fuel independent” technologies
- Flexible electric power grid
- Distributed on-site locations
- Advanced communications and controls
- Alternative transportation fuels

Renewable Energy

- ▶ Biopower
- ▶ Solar Technologies
- ▶ Wind
- ▶ Geothermal
- ▶ Hydrogen
- ▶ Hydropower



Natural Gas Technologies

- ▶ Industrial Gas Turbines
- ▶ Microturbines
- ▶ Thermally Activated Technologies
- ▶ PEM Fuel Cells
- ▶ Internal Combustion Engines
- ▶ Balance of Plant (hybrids, CHP, sensors)



Transmission and Distribution Infrastructure

- ▶ Power Delivery
- ▶ Superconductivity
- ▶ Transmission Reliability
- ▶ Energy Storage
- ▶ Smart Controls
- ▶ Interconnection

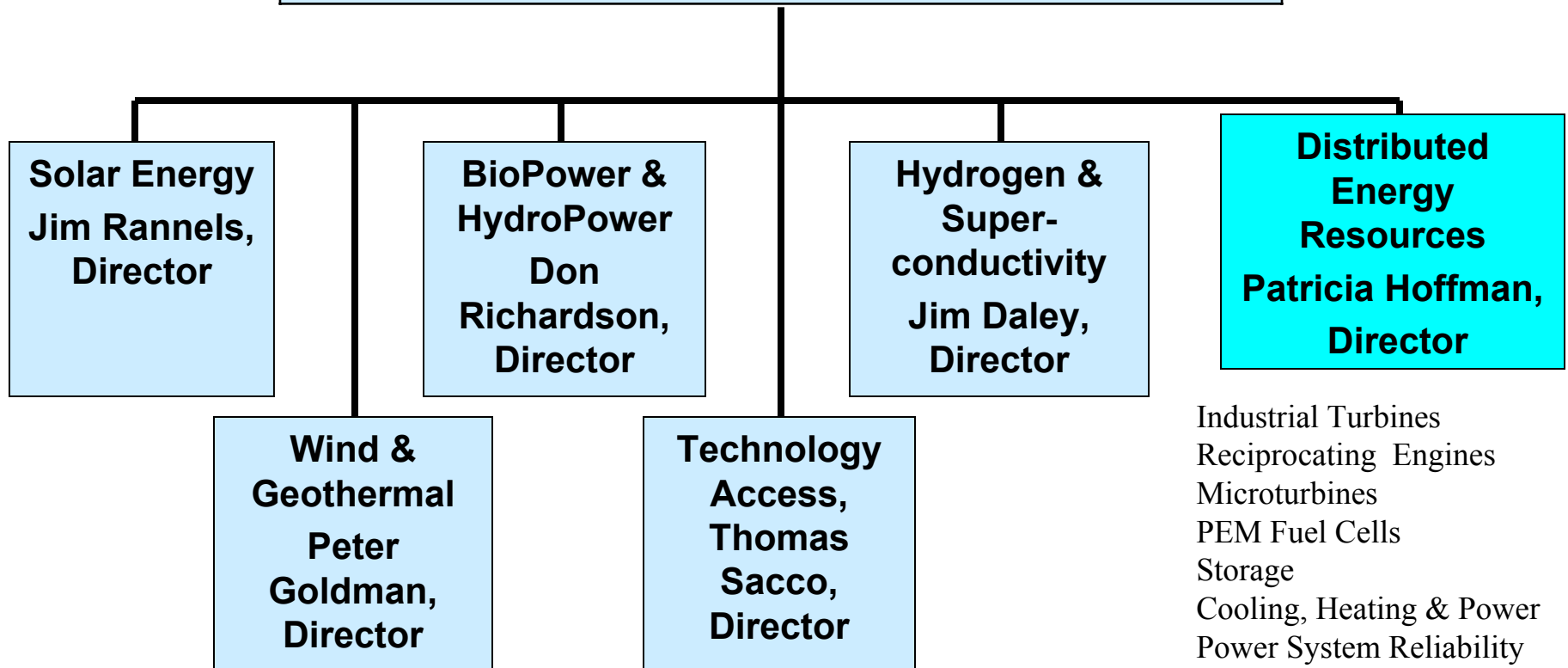


Energy Efficiency and Renewable Energy-



Office of Power Technologies

Robert K. Dixon, Deputy Assistant Secretary
William Parks, Associate Deputy Assistant Secretary



Industrial Turbines
Reciprocating Engines
Microturbines
PEM Fuel Cells
Storage
Cooling, Heating & Power
Power System Reliability
Distributed Power
Electric Restructuring
Transmission and Distribution

Program Portfolio

Fuel



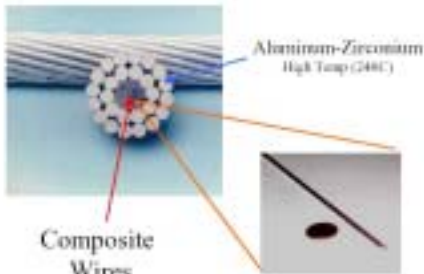
Technology Development:
Microturbines, reciprocating engines, fuel cells, materials, storage

Technology Packages:
Integrated CHP systems, chillers, desiccants

End-use Integration: Demand management, controls, sensors



Composite Conductor

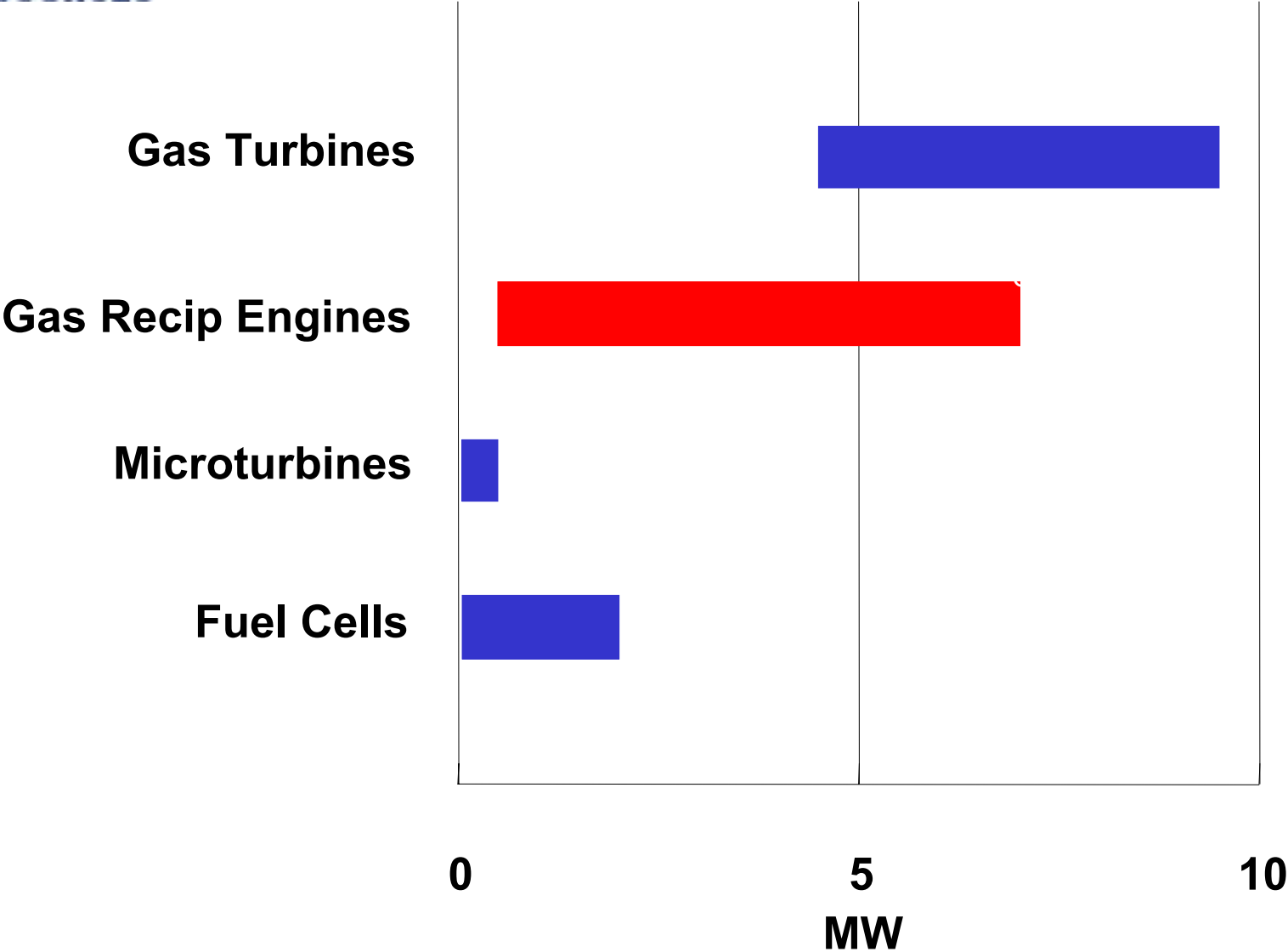


Electric and Gas Integration:
Load management, sensitive loads, power electronics

Distribution System:
Load management, power parks, microgrids, storage, ups, control, DC grids

Transmission System: wire materials, tools

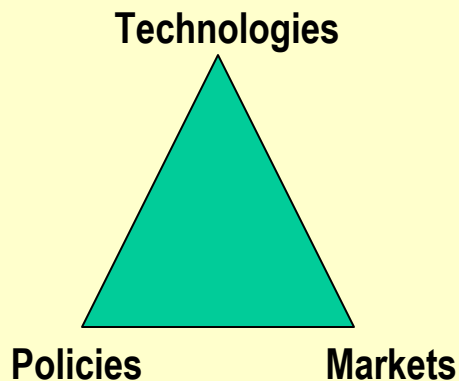
Primary DER Solutions



The Strategy



An Integrated Approach



RD&D



Public-Private
Partnerships



Energy and
Environmental
Policies



The Ultimate Goal

A competitive marketplace for expanding the use of clean, efficient, reliable, and affordable distributed energy resources

▶ Technology Development

- **Energy Storage \$4.4 (\$5.9)**
- **Microturbines \$11.0 (\$7.0)**
- **Reciprocating Engines \$11.0 (\$3.0)**
- **Industrial Gas Turbines \$4.5 (\$4.5)**
- **Building PEM Fuel Cell \$4.0 (\$5.5)**
- **Thermally Activated Technologies \$16.660 (\$14.66) includes desiccants, heat pumps, chillers, chp package systems**
- **Technology Base\$7.76 (\$8.76) includes oil combustion, materials activities**

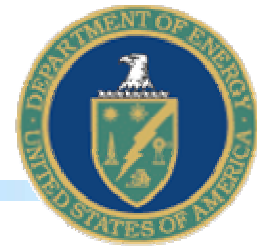
▶ Systems Integration

- **Transmission \$3.55 (\$4.97)**
- **Systems Integration/Interconnection: Distributed Power \$3.55 (\$3.98)**
- **Electric Restructuring \$1.0 (\$1.0)**
- **Distributed Generation Systems Integration: Industrial/Commerical \$3.45 (\$0.95) includes High-Tech solicitation**
- **CHP Integration \$2.0 (\$1.0) includes CHP roadmap implementation and package systems**
- **Communications and Control \$0.5 (\$0.0)**

1. 2001 in brackets
2. **Green- EWD funds**
3. **Black- Interior funds**



DER 2002 Appropriations



► Interior

- Microturbines \$11.0 (\$7.0)
- Reciprocating Engines \$11.0 (\$3.0)
- Industrial Gas Turbines \$4.5 (\$4.5)
- Building PEM Fuel Cell \$4.0 (\$5.5)
- Thermally Activated Technologies \$16.660 (\$14.66) includes desiccants, heat pumps, chillers, chp package systems
- Technology Base \$7.76 (\$8.76) includes oil combustion, materials activities
- Distributed Generation Systems Integration: Industrial/Commercial \$3.45 (\$0.95) includes High-Tech solicitation
- CHP Integration \$2.0 (\$1.0) includes CHP roadmap implementation and package systems
- Communications and Control \$0.5 (\$0.0)

► Energy and Water

- Transmission \$3.55 (\$4.97)
- Systems Integration/Interconnection: Distributed Power \$3.55 (\$3.98)
- Energy Storage \$4.4 (\$5.9)
- Electric Restructuring \$1.0 (1.0)

► EARMARKS

- \$1.0 battery (Ni-metal hydride)
- \$3.0 Thermal energy storage
- \$4.0 aluminum composite conductor
- \$1.0 fuel cell smart home/Alabama
- \$2.0 UADispatch/Alabama
- \$3.0 Indiana distributed generation
- \$2.0 Glenallen power upgrade
- \$2.0 Keckemak Bay extension and upgrade
- \$3.0 Swan Lake-Kate Tyee electrical intertie
- \$3.0 Prince of Wales electrical intertie
- \$0.5 New Mexico Tech and National Energy Laboratory of Hawaii

Partnerships

